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BEFORE THE BOARD OF PATENT APPEALS

AND INTERFERENCES

Paper No. 35

Application Number: 09/114,203

Filing Date: 7/13/1998

Appellant(s): Miyanishi et al.

Ellen Marcie Emas

For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 3/10/2002.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is substantially correct. The changes are as follows: Applicants correctly note in the second issue that the Examiner rejected claims 14-16 and 20-23 over Shou/Bergemont/Jassowski. However, the Examiner's inclusion of claim 23 in this particular rejection was a typographical error. The rejection was intended to state that claims 14-16 and 20-22 are rejected over Shou/Bergemont/Jassowski. This intention is evidenced by the fact that product claim 17, which corresponds to method claim 23, was not included in the rejection based on Jassowski. While Jassowski does provide

further support for the Examiner's position, and in no manner whatsoever teaches away from the obviousness of claim 23, its further teachings are not necessary to support the 103 rejection that was intended to be based exclusively on Shou/Bergemont. This correction should reduce the issues on appeal.

(7) Grouping of Claims

The appellant's statement in the brief that certain claims do not stand or fall together is not fully agreed with because the pending claims are variously, either directed towards or generic to respective ones of the three pending species/embodiments set forth in FIGs 24/25, 26/27 and 28. More specifically,

* Each of the respective product claims, 13-18, substantially correspond to respective ones of the method claims, 19-24. As such, the corresponding product and method claims (i.e., product claim 13 & method claim 19, product 14 & method 20, ... 18 & 24) **do** respectively stand or fall with each other.

* Claims 15 and 21 (which are directed towards the FIG 24/25 embodiment); claims 16 and 22 (which are directed towards the FIG 26/27 embodiment); and claims 17,18, 23 & 24 (which are directed towards the FIG 28 embodiment) **do not** stand or fall together as they are respectively directed towards distinct embodiments.

* Claims 14 and 20, being generic to the two FIG. 24/25 and FIG. 26/27 embodiments, **fall--but do not necessarily stand**--with any of claims 15, 16, 21 and 22.

* Claims 13 and 19, being generic to all three FIG. 24/25, FIG. 26/27, and FIG. 28 embodiments, **fall--but do not necessarily stand**--with any of claims 14-18 and 20-24.

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

The following is a listing of the prior art of record relied upon in the rejection of claims under appeal.

5,811,859	SHOU et al.	9-1998
WO 94/29898	BERGEMONT (or NSC)	12-1994
5,668,389	JASSOWSKI et al.	9-1997

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 13, 17-19, 23 and 24 rejected under 35 U.S.C. 103(a) as obvious over Shou et al. '859 in view of Bergemont WO '898.

a. Shou depicts inverter circuits having various active regions including PL1 and NL1. See e.g., PL1 wherein a recessed region (strangulation region S1) is disposed between two ordinary regions. The left portion of the ordinary region has a first MOS transistor with a first gate electrode G disposed between source/drain (S/D) regions having contacts C1 and C3, respectively. The recessed region has a second MOS transistor with a second gate electrode G. Both of these gates have upper ends which are formed in a line. (Hereinafter, the gates formed on the ordinary region and the recessed region will be referenced as "the ordinary gate" and "the recessed gate," respectively, for the sake of brevity.)

While the reference unequivocally depicts the two gates terminating at a common line, the reference does not expressly *depict* this common line being at a point that is beyond the edge of the active region PL1 (i.e., the reference does not expressly depict the presence of an end cap at the end of the ordinary gate). Nonetheless, one skilled in the art would understand that the ordinary gate must necessarily extend at least some distance onto the surrounding oxide region (i.e., that end caps must necessarily be present on the ordinary gate as well as the recessed gate); otherwise the source/drain regions of the ordinary region would

be inclined to short and the transistor would not operate as intended. Thus, Shou inherently discloses the presence of the end caps.

b. Alternatively, even assuming *arguendo* that Shou must be interpreted so narrowly as not expressly teaching the presence of the end cap on the ordinary gate, the claims would have been obvious since its presence is implied. Further, Bergemont discloses that poly end cap rounding is a conventional problem wherein an end cap does not sufficiently extend onto the surrounding oxide, resulting in undesirable leakage currents. The reference further discloses that it was conventional to avoid this problem by increasing the length of the end cap (page 1, Discussion of Prior Art and particularly lines 30-33). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention that the gate in the ordinary region of the Shou reference must--or at least very preferably should--also possess an end cap margin for the purpose of preventing the undesired current leakage, as taught by Bergemont.

c. Shou also depicts the strangulation region as having a semicircular shape as opposed to being formed by first, second and third edges at right angles. Bergemont teaches an insulating field oxide (FOX) protrusion (or active area recess) with sides formed at right angles (see e.g., FIG 1A). It would have been obvious to one of ordinary skill in the art at the time of the invention to form the recessed portion of Shou with straight sides having right angles--at least to the extent afforded by then-existing processing techniques--as taught by Bergemont for conventional business reasons such as for simplifying the mask design and manufacturing process.

2. Claims 14-16 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shou '859/Bergemont '898 as applied to the claims above, and further in view of Jassowski et al. 389.

a. As was stated above, Shou teaches, either alone or in combination with Bergemont '898, active regions having gates extending from ordinary regions and recessed regions wherein the recessed gate endcap extends so that its edge is in line with that of the ordinary gate's edge. Bergemont '898 depicts (see FIGS 1A-1C) gate end caps that extend onto a recessed portion that has first and second edges extending perpendicular to the third edge thereby forming the recess. Bergemont further teaches that it was conventionally known that the gate margin may be increased in this situation to prevent source/drain (S/D) shorting or punchthrough. Neither Shou nor Bergemont teaches that the first edge may be longer than the second edge (i.e., that one ordinary region may extend further than the other ordinary region), as required by claims 14 and 20.

b. Jassowski '389 depicts (See Fig 2 as labeled by the Examiner) at least one active region having an ordinary region from which gate G3 extends and having a first edge E1; a second region having a second edge E2 that is shorter than E1; and a depressed region having an edge E3 from which gate G4 extends. Both of these gates, G3 and G4, have endcaps. It would have been obvious to one skilled in the art at the time of the invention to provide an active region having a first edge that is longer than the second edge, as taught by Jassowski depending only upon the specific application for which the active region is to be employed.

c. Claims 14 and 20 further require that the endcap margin length of the recessed gate be longer than the second length. While the margin of gate G4 is not longer than edge E2, the claims nonetheless would have been obvious for the following reasons:

i. Jassowski teaches a recessed-endcap-length-range lower boundary limit of having the second (recessed) gate length shorter than the second edge, while Shou teaches a recessed-endcap-length-

range upper boundary limit wherein the second gate length is not only longer than the second edge, it also extends to the same line as that of the first (ordinary) gate edge. Coupling these two boundary points with the teachings of Bergemont--that the length of a recessed gate's margin may be increased in order to ensure that no shorting occurs--renders it obvious to one of ordinary skill in the art at the time of the invention that the length of the recessed gate margin could alternatively be formed of any length intermediate between these lower and upper boundary limits, depending only upon the specific application intended for the active region as this dictates various conventional details such as the channel width and length, which in turn, dictates the length and spacing requirements for the three edges of the recessed portion and the layout constraints for the circuit cell.

ii. This position is further supported by other teachings of Jassowski. Specifically, gate G1 is also formed on another recessed portion. This gate is disposed so closely to the edge E5 that the gate length is set to a length of E5 plus the length of the gate G2 endcap. Note that E5 is less than E1. This provides support for the position that in those situations wherein a recessed gate is formed very close to an active edge (be it in the middle of an active region as set forth in claims 15 and 21 or at a corner region as depicted in the specific embodiment of Jassowski), it would have been obvious to one skilled in the art at the time of the invention to extend the gate to the same length that is set for the margin of the non-recessed region for the purpose of preventing shorting in case of misalignment or rounding, as taught by Jassowski and Bergemont.

d. Again, the foregoing analysis sets forth the boundary conditions for the recessed gate's margin length and various reasons for altering this length anywhere in between these two points. As such, these reasons also render claims 16 and 22 obvious because it has been held that where the general conditions of a

claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. In the present case, the general conditions and the working ranges have been taught by the combination of the prior art references, and setting the gate length as set forth by these claims does not provide any unexpected results.

(11) Response to Argument

A. Claims 13, 17-19, 23 and 24 are obvious over Shou and Bergemont.

The Examiner will address Applicants' arguments in relation to product claim 18, as that claim (and substantially identical method 24) is (/are) the narrowest in scope, and the rest of claims 13, 17, 18 and 23 (as well as claim 24), fall with claim 18.

Most of the lengthy claims' limitations are not in dispute. Rather, this portion of the present appeal is based on two issues associated with the two specified gates G and S of Shou, Fig 3: (1) would it have been either inherent or obvious that both of the two gates extend to a common line that is beyond the edge of the active region? And (2) would it have been obvious to form the strangulation (or recessed) portion with three straight lines as opposed to with a u-shaped edge? These two issues will be addressed in the following first two sections and third section, respectively.

1. The two gates of Shou necessarily have endcaps that terminate on a common line that is beyond the edge of the active region.

Applicants state that Shou's second, recessed gate S1 has an end cap, and that the end cap extends "only to the edge of the PL region [or ordinary active region]." (Appeal Brief, page 9, first full paragraph.) Applicant also argues that the edge of the first, ordinary gate G "is shown so that it matches the edge portion of the active region PL1." (Appeal Brief, page 8, last paragraph.) Restated, while Applicants argue that the edge of the ordinary gate does not form an endcap, Applicants' admit that the ends of the first and second gate electrodes are in a common line as required by claim 18. Thus, the issue devolves to (1) whether this common gate-edge line is aligned with the active region edge portion as Applicants argue (in which case, the ordinary gate does not have an end cap), or alternatively (2) whether this common line necessarily extends to some point beyond the active region's edge onto the insulating field oxide, as the Examiner maintains (in which case, the ordinary gate does, in fact, also have an end cap).

The Examiner has previously explained in the body of the rejection, that notwithstanding the generalized schematic illustration of FIG 3, one skilled in the art would readily understand that the ordinary gate also must necessarily extend beyond the active region onto the field oxide because, if it did not, the circuit would not operate as intended. This is because if the gate end did not extend onto the adjacent insulating region, the MOSFET's source and drain would be subject to current leakage or short-circuit, rendering the transistor inoperable.

Applicants have not presented any arguments as to why this asserted fact is not true: e.g., Applicants have not argued that it is possible to form the ordinary gate so as to be properly operable without an endcap. Rather, Applicants have merely argued that Shou does not recognize, address, or discuss the problem of not

providing an end cap. (Appeal Brief, page 8, last paragraph.) However, the fact that Shou does not expressly discuss this particular feature in the written portion of the reference does not lead to the conclusion that the necessity of endcaps was not known to Shou, let alone the skilled artisans. Rather, Shou's omission of expressly discussing the presence of either the ordinary gate's end cap or the recessed gate's end cap (which applicant admits Shou teaches) is indicative of the fact that the need for, and function and formation of, end caps was so well established that express written explanation of this feature within the reference was not needed. This position is supported by the fact that applicants acknowledge that the need for, and use of, end caps was already conventionally known: see e.g., prior art FIG 29, and the associated discussion in the BACKGROUND section of the specification relating to ordinary-gate endcap 2 as well as recessed-gate endcap 3.

In summary, the Examiner has met the burden of proof of showing that an endcap is inherently present on the ordinary gate. This is because the Examiner's position is supported by the stated basis in fact and/or technical reasoning as required to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. See MPEP 2112, third subsection titled, **EXAMINER MUST PROVIDE RATIONALE OR EVIDENCE TENDING TO SHOW INHERENCY**. Once the Examiner has made this showing, the burden shifts to Applicant to refute this showing. See MPEP 2112, fourth subsection titled, **ONCE A REFERENCE TEACHING PRODUCT APPEARING TO BE SUBSTANTIALLY IDENTICAL IS MADE THE BASIS OF A REJECTION, AND THE EXAMINER PRESENTS EVIDENCE OR REASONING TENDING TO SHOW INHERENCY, THE BURDEN SHIFTS TO THE APPLICANT TO SHOW AN UNOBVIOUS DIFFERENCE**. In the present case, Applicants' arguments are directed solely towards the fact that Shou does not expressly disclose the ordinary gate endcap. Applicants' have not presented any

arguments or evidence explaining why the endcap is not necessarily present. As such, Applicant can not be said to have met their burden of refuting the inherency of this feature.

2. It would have at least been obvious to have formed the two gates of Shou so as to have endcaps that terminate on a common line that is beyond the edge of the active region.

The rejection over Shou/Bergemont was alternatively based upon the theory that if, for some reason not at all apparent to the Examiner, the ordinary gate does not necessarily have to have an endcap (thereby refuting inherency), it would have at least been obvious to provide such an endcap because its presence is so desirable for the reasons set forth.

Applicant admits that Bergemont teaches that (1) the use of end caps was known; (2) the problem of current leakage resulting from endcap rounding and recessed active region rounding was known; and (3) it was conventional to compensate for the leakage current problem by increasing the length of those endcaps that are associated with gates formed in an active-region's recessed portion. (Appeal Brief, pages 9-10.) However, Applicant argues that Bergemont does not teach setting the length of the recessed endcaps differently from that of the ordinary endcaps (as required by claims 13 and 19); nor setting them such that the recessed endcap extends beyond the edges of either ordinary region (as required by claims 17 and 23); nor further teaches setting these respective endcap lengths such that their edges are in a common line as required by claims 18 and 24 (Appeal Brief, page 10).

The Examiner's position never was that *the Bergemont reference* teaches these limitations. Rather, the Examiner's position was and is (1) that Bergemont teaches that endcaps must be associated with those gates that terminate near the active region boundary to prevent current leakage or shorting; (2) that Shou is

the reference that teaches that it was known to form gates on ordinary regions and adjacent recessed regions such that the recessed gate endcap has a length that is not only longer than that of the ordinary gate's end cap, but is specifically of such an additional length that the edges of the two gates form a line, as required by claim 18. Further, it was and is the Examiner's position that Shou teaches this relative length relationship irrespective of whether the ordinary gate endcap length is specifically zero (or restated, whether the ordinary gate has no endcap, as Applicants contend) or alternatively, whether the endcap length is, in fact, a length of some positive value greater than zero (as the Examiner contends). Restated, Applicants have argued that Shou does not teach those elements that appear in Bergemont and that Bergemont does not teach those elements that appear in Shou. However, this is precisely why the references were combined.

Applicants further argue that the Examiner is selecting bits and pieces from those references (thereby constituting an admission that the two references in combination do teach all of the claims' elements) without considering the remaining teaches which would lead away from the claimed invention (Appeal Brief, page 6, last paragraph). Applicant's position that the references teach away from the present invention, is based solely on the assertion that a combination of the references would lead the skilled artisan to make all of the same end caps of the same length in accordance with Bergemont. In fact, though, while the skilled artisan would certainly understand that this is one possible solution, Applicant has not explained why the skilled artisan would not also find it obvious that the two endcaps could be formed of different lengths so as to terminate on a common line, as taught by Shou. Restated, the fact that the prior art may also teach additional potential solutions that are alternatives to the particular solution set forth in the rejection, does not mean that the combination of references teaches away from the solution set forth in the rejection.

3. It would have been obvious to have formed the strangulation (or recessed) portion with three straight-line edges as opposed to with a u-shaped edge.

Applicant asserts that Shou does not teach the recessed gate extending from or beyond straight line edges within the context of the previous arguments relating to the previous arguments relating to the two endcaps' relative distances. But it does not appear that Applicant has presented any arguments specifically relating to any purported errors with the Examiner's position that it would have been obvious to have formed the u-shaped recessed portion of Shou alternatively with straight lines edges. Since the Examiner has previously set forth the basis and motivation for this modification and since Applicants have presented no arguments on appeal to rebut the Examiner's position, no response is required for this issue.

B. Claims 14-16 and 20-22 are obvious over Shou/Bergemont further in combination with Jassowski.

Most of Applicants' arguments can be summarized as follows: each one of Shou, Bergemont and Jassowski do not individually teach all of the claimed elements. The Examiner agrees. If any reference had taught all of the elements, a 102-anticipation rejection would have been issued instead of the 103 rejection that was, in fact, issued.

Applicants further argue that the Examiner is misinterpreting Shou and Bergemont and impermissibly modifying Jassowski in light of Applicant's teachings (Appeal Brief, page 12, paragraph A). The Examiner has already explained hereinabove why the Examiner's interpretation of Shou and Bergemont was proper. In response to applicant's second argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only

knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In order to clarify that the Examiner's rejection was not based upon impermissible hindsight the rejection is now resummarized.

Bergemont stands for the proposition that it was known to increase the length of endcaps associated with gates that terminate in a recessed portion of an active region. Bergemont does not specifically say how much further this endcap length may be increased. This is not in dispute.

Shou stands for the propositions that it was known to form active regions with gates formed on both ordinary portions and recessed portions, and that it was known that the recessed gate may be formed with an endcap that extends a greater distance beyond the active area edge than does the ordinary gate edge, such that the edges of the two gates form a line. This is not in dispute. As such, because of the Examiner's rationale relating to the inherency/obviousness of the provision of an ordinary endcap that extends beyond the ordinary region as set forth above, the combination of Shou and Bergemont render obvious both the claims that are directed towards the FIG 28 embodiment (claims 17, 18, 23 and 24) and the claims that are generic to the FIG 28 embodiment (claims 13 and 19). Shou also serves to set an upper length boundary for the Bergemont range of relative distances by which the recessed endcap may exceed that of the ordinary endcap: the recessed endcap may extend to a length that is longer than either of the two adjacent ordinary active region side-walls plus an additional distance so as to form a line with the edge of the ordinary endcap.

Jassowski stands for the propositions (1) that it was known to form a recessed portion between two ordinary portions that, in turn, have differing sidewall lengths; (2) that it was known to form endcaps on both

the ordinary region and recessed regions; and (3) that it was known to form the endcaps so that they respectively have the same endcap length (see Fig 2, ordinary gate G3 and recessed gate G4). Restated, Jassowski serves to set a lower-length boundary for the Bergemont range of relative distances by which the recessed endcap may exceed that of the ordinary endcap: zero additional distance. This is not in dispute.

Bergemont further teaches that when recessed gates are formed close to the side of an ordinary region, the recessed endcap length may be increased to some point that may be deemed to be either intermediate between the two end-points of the Bergemont range (i.e., recessed gate G1 does not extend as far as ordinary gate G3) or alternatively deemed to extend to the upper boundary of the range (the edge of recessed gate G1 extends to the same line as that of ordinary gate endcap G2). While Jassowski's gate G1 is formed in the specific embodiment of what Applicant's term "a corner portion" as opposed to a "recessed portion" (wherein ordinary regions are formed on both sides of the recess as opposed to only one side), this fact in no manner teaches away from the obviousness of forming such an "intermediate-length" endcap between two ordinary regions. The Examiner explained the motivation for this position: that the specific desired circuit application dictates various conventional details such as the channel width and length, which in turn, dictates the length and spacing requirements for the three edges of the recessed portion and the layout constraints for the circuit cell. Applicant has not argued that this motivation is not true nor well-known.

As such, Jassowski supplements the Shou/Bergemont teaching (that recessed endcaps may have longer lengths that extend to the upper limit of being in line with the ordinary endcap edge) by additionally teaching that the recessed endcap may have a length that is either (1) the same as the length of the ordinary endcap (constituting a lower limit) or alternatively (2) of a length that is intermediate between the lower, same-cap-length limit and upper, common-line-edge limit. Furthermore, the Examiner's motivation for

combining the references was proper for the reasons set forth during prosecution and restated presently hereinabove. Therefore, Shou/Bergemont/Jassowski expressly sets forth all of the limitations of claims 14, 15, 20 and 21, and renders these claims obvious.

The only limitation that Shou/Bergemont/Jassowski do not expressly teach, is the limitation set forth in claims 16 and 22, relating to the recessed endcap having an intermediate-range length that is specifically set to be a distance x beyond the hypothetical intersecting diagonal (See Applicant's FIG 26). However, the Examiner had additionally explained why this limitation was also rendered obvious. Specifically, it was upon the stated bases that (1) where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art (*In re Aller*, 105 USPQ 233); and (2) that in the present case, the general conditions and the working ranges have been taught by the combination of the prior art references, and setting the gate length as specifically set forth by either of these two claims does not provide any unexpected results. Applicant has not argued that this well-established legal principle should be modified or overturned. Further, Applicant has not asserted--either during prosecution nor on appeal--that any unexpected results, whatsoever, arise from selecting this specific intermediate length from within the range of known lengths taught by Shou/Bergemont/Jassowski.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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May 4, 2003

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